REMARKS

By this Amendment, the specification and the claims have been amended to overcome the objections and rejections set forth in the Office Action. These amendments are summarized as follows.

A typo in paragraph [0037] has been corrected to change the first instance of the numeral 110 to the numeral 108, thereby overcoming the objection to the drawings set forth in the Office Action. This change clearly does not present any new matter.

The claim objections note in section 2 of the Office Action have been addressed, though the Examiner's suggested change to claims 6, 10, 17 and 21 has not been made. Instead, the claims have been amended to recite more clearly that three input values, three inference rules, and three output values are employed.

The rejections of claims 1-22 under 35 U.S.C. 101 as being directed to non-statutory subject matter are believed to be overcome by the amendments to the independent claims 1, 8, 12, and 19. With specific reference to these amendments, method claims 1 and 8 have been amended to recite that the images are retrieved from an external source of images and that the image analysis application is run by the computer. This change satisfies one of the suggested examples set forth in the Office Action that the claimed process represents activity transformed from outside the computer. Claims 12 and 19 have also been amended to specify the external source of gray scale images. In addition, the program is recited as being embodied in the operating memory, which is readable by the processor to execute the steps of the program to retrieve the gray scale images and analyze them for edges in accordance with the novel process of the claimed invention. As with claims 1 and 8, these changes

clearly establish the claimed invention as being statutory and having a practical application under 35 U.S.C. 101.

Turning now to the prior art rejection set forth in the Office Action, claims 1-22 stand rejected under 35 U.S.C. 103 as being unpatentable over the publication to El-Khamy in view of US 6,665,439 to Takahashi and US 6,424,736 to Meitzler et al. Applicant respectfully traverses this rejection of the claims in view of the amendments to the claims and the following arguments.

The present invention relates to a method and corresponding system for facilitating identification of edges in multiple pixel digital gray scale images. The invention employs fuzzy reasoning to determine, on a pixel by pixel basis, the likelihood that a selected pixel in the image represents a portion of an edge in the image. Once each pixel in the image is analyzed for "edginess," the degree to which the pixel is an edge, it becomes a simple process to identify edges in the image by locating adjacent pixels that have been classified as edges by the invention.

The invention uses an analysis technique that does not involve extensive processor overhead and can be carried out quickly by avoiding complex calculations, such as those used in El-Khamy for example. For each pixel in the image to be analyzed, each of a plurality (preferably 4) of potential edge paths is analyzed to identity the difference between pixel values on one side of the edge path and those on the other side of the edge path. The path with the highest gradient value is selected as a possible edge and is input to a fuzzy membership function which determines the likelihood that the edge path is an edge and outputs a plurality of values indicating the likelihood that the selected pixel is on an edge.

Returning now to the rejection set forth in the Office Action and with reference first to El-Khamy, this document discloses a totally different, much more complex technique for identifying edges and other patterns in images. In El-Khamy, five different patterns are selected for each pixel and the pattern information is passed through five different membership functions, one for each pattern. Each of these membership functions employs different parameter constants. The outputs of the membership functions are then analyzed to determine whether a given pixel is on an edge or not.

Takahashi, on the other hand, does not employ fuzzy reasoning at all and instead uses a more complex edge by edge analysis in which pixel values immediately adjacent the pixel being analyzed are given more weight than other pixels. Thus, Takahashi's process does not measure the actual pixel gradients on both sides of the edge path.

The Examiner asserts that it would be obvious to combine the teachings of El-Khamy and Takahashi and arrive at steps 1-4 of claim 1, for example. The assertion is incorrect, especially in view of the changes made to the independent claims. Claim 1 has been amended to incorporate among others, the limitations of claim 2. Claim 1 as amended clearly recites that plural edge paths are identified, but only the one with the maximum gradient is passed through a fuzzy membership function. This is in contrast to El-Khamy's method which passes the information for each edge path through its own corresponding membership function. Further, In contrast to Takahashi, the gradients are calculated by taking the difference in pixel values between the two sides of each edge path. As noted above, Takahashi performs other analysis regarding immediately adjacent pixels to determine which edge path should be selected. The present

invention in claim 1 as amended, however, selects the edge path with the greatest gradient and passes this gradient value through a membership function for further analysis.

Each of the independent claims has also been amended to specify an additional step that is neither disclosed nor suggested in the references of record. This step is assigning a new edginess based gray level value to each pixel by multiplying the original gray level value of the selected pixel by the calculated crisp edginess value so that the edginess based gray level value is proportional to the edginess degree of the selected pixel. This step enhances the contrast between pixels which are likely on an edge and those pixels which are not likely on an edge.

In view of the foregoing reasons alone, the combination of El-Khamy, Takahashi and Meitzler do not establish a prima facie case of obviousness under 35 U.S.C. 103 as to any of the claims as amended. In each case, the claims include elements neither disclosed nor suggested in the combination of these references.

Further, while Meitzler et al. discloses centroid averaging, claims 7, 10 and 20 have been amended to specify that the recited weighted averaging analysis comprises an averaging union of truncated output singletons, which is the preferred embodiment of the invention. This technique further simplifies the analysis process. None of the references of record, including Meitzler et al., disclose or suggest this feature. For this reason also, claims 7, 10, and 20 are patentable over the references of record.

In view of the foregoing, Applicant respectfully submits that the claims as amended are allowable and that the application is now in condition for allowance. Accordingly, favorable reconsideration of the application is respectfully requested.

The Examiner is invited to contact Applicant's Representative at 321-867-7214 if there are any questions regarding the Response or if prosecution of this application may be assisted thereby. No new matter has been entered and no additional fee beyond the two-month extension of time previously paid for is required by this Response. Please charge any additional fees necessary to maintain pendency of this patent application to Deposit Account No. 14-0116.

Respectfully submitted,

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Date

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